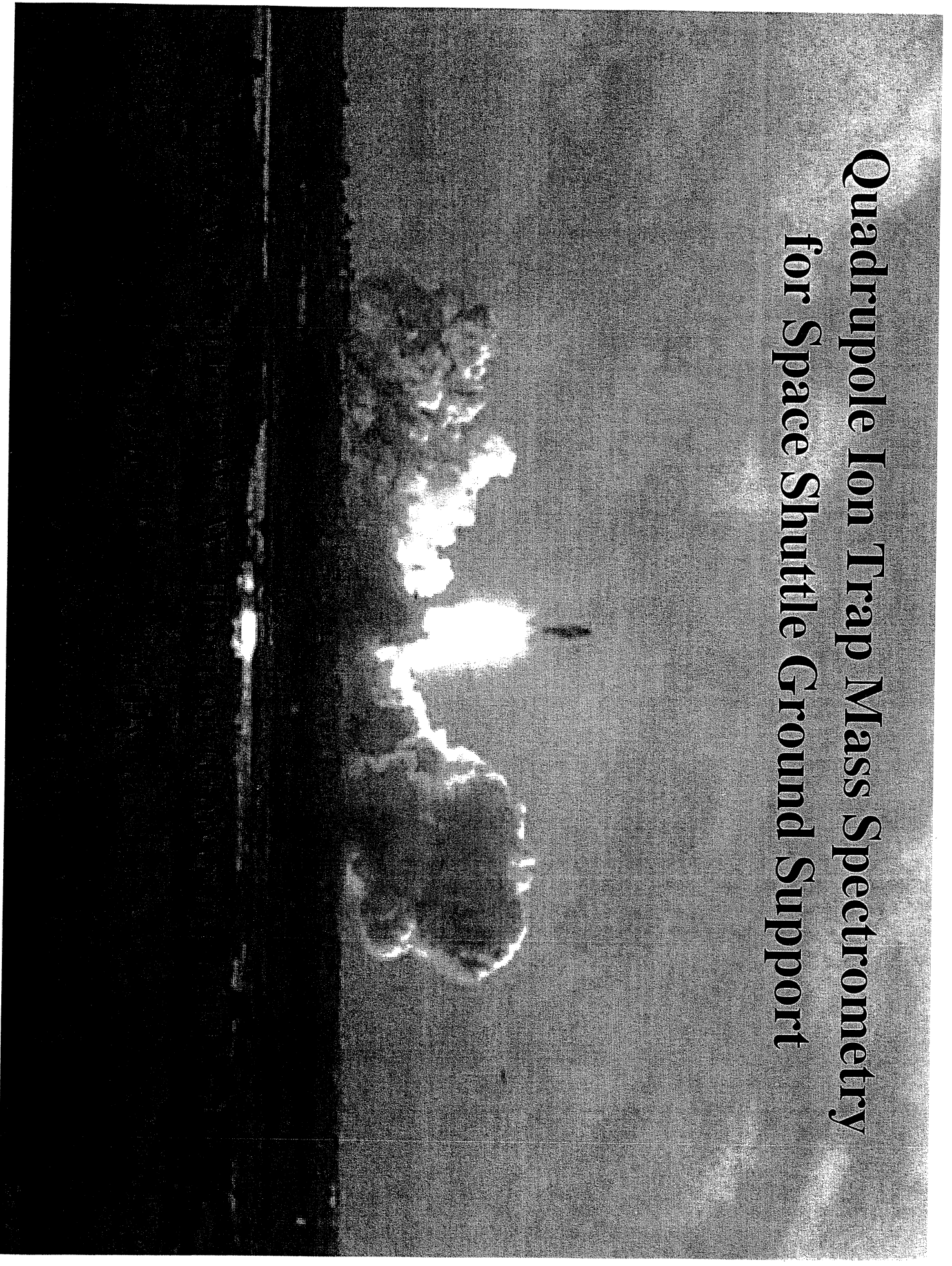
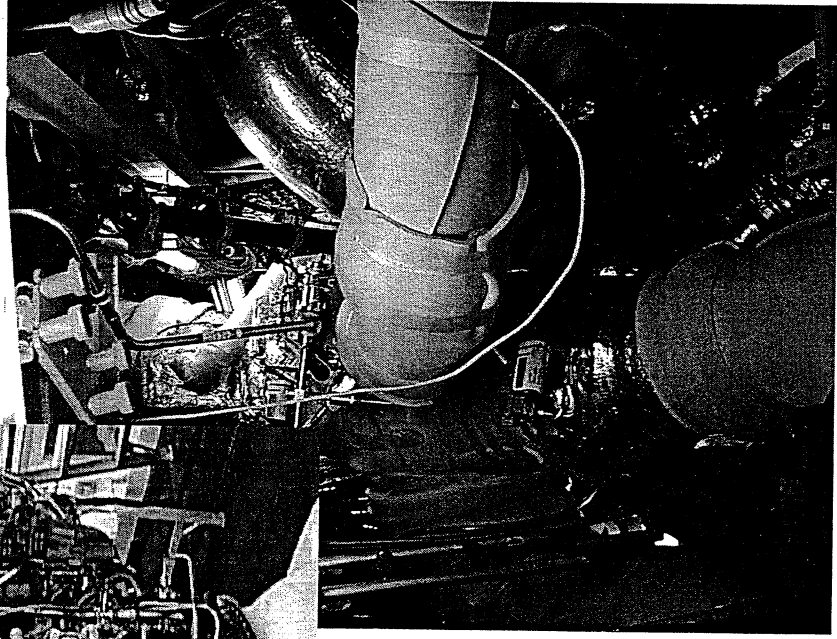
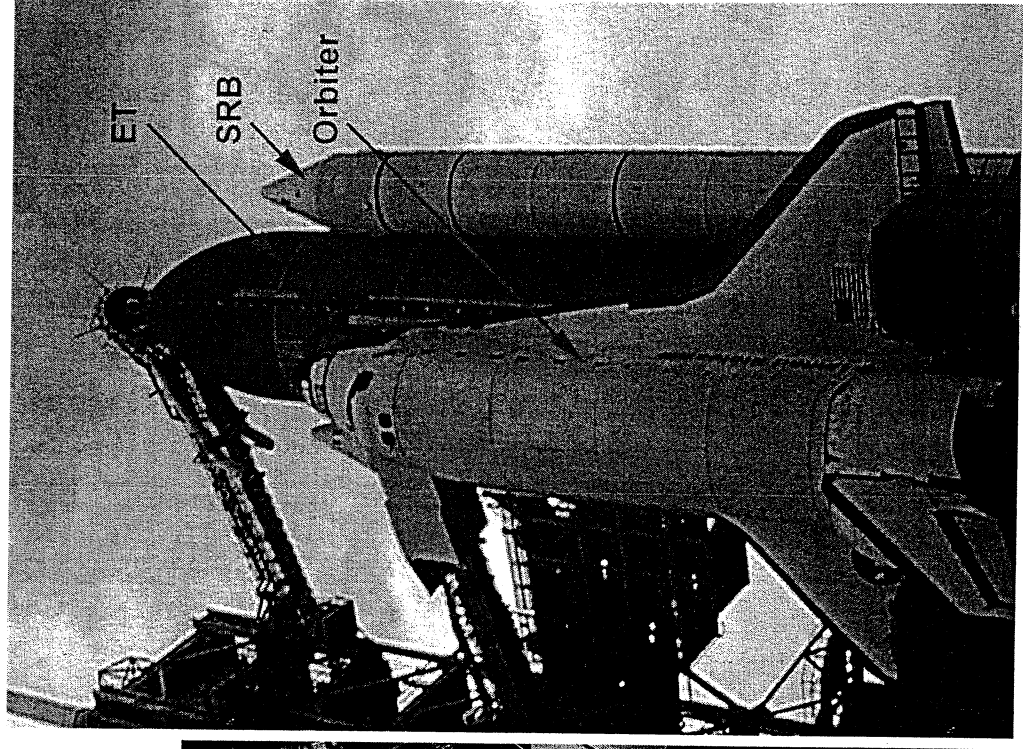
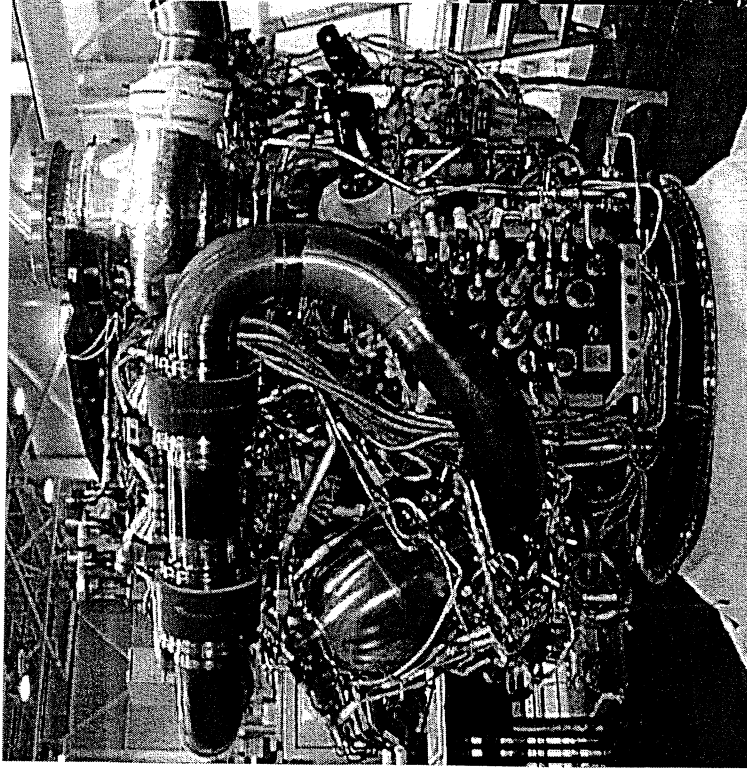


Quadrupole Ion Trap Mass Spectrometry for Space Shuttle Ground Support



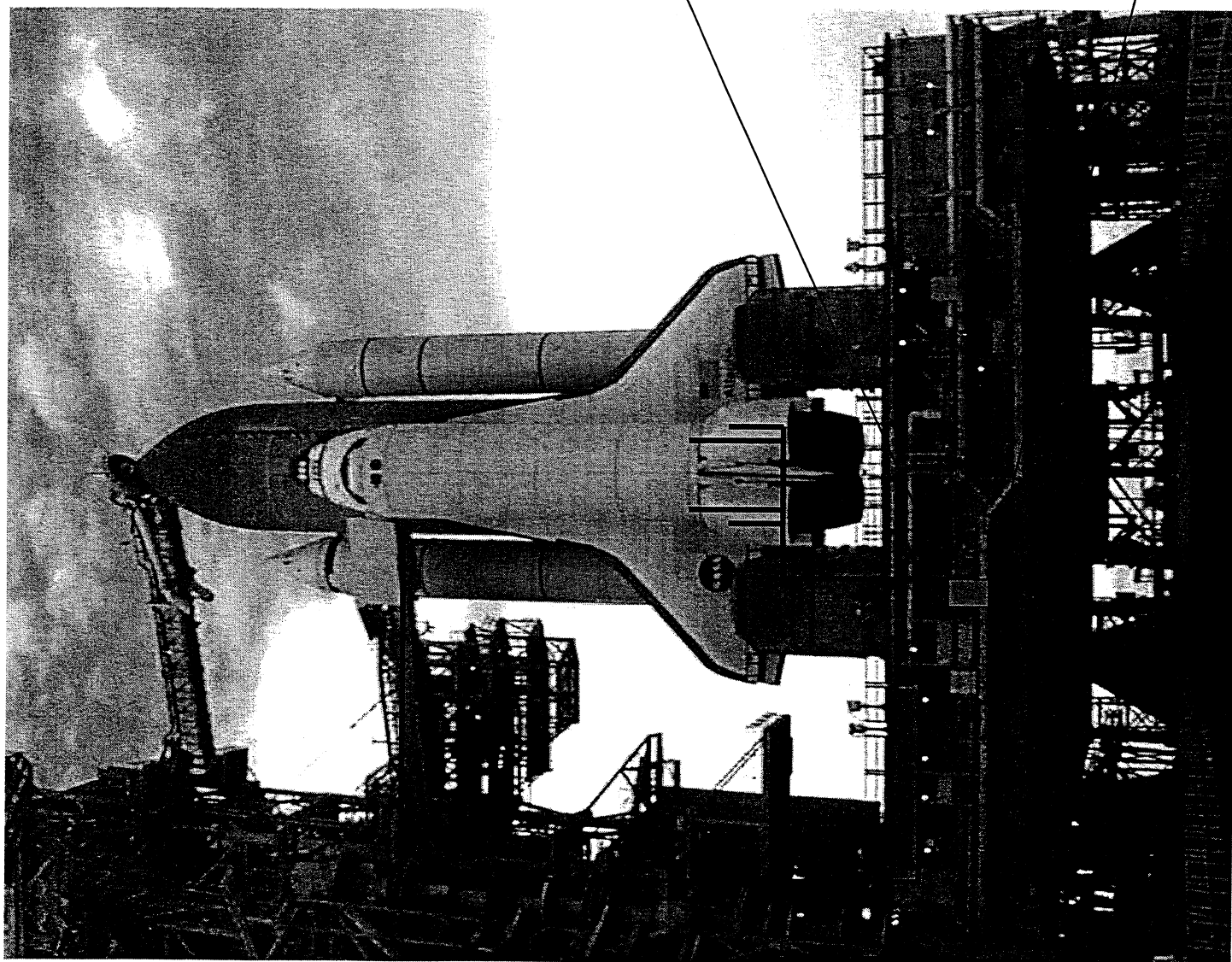
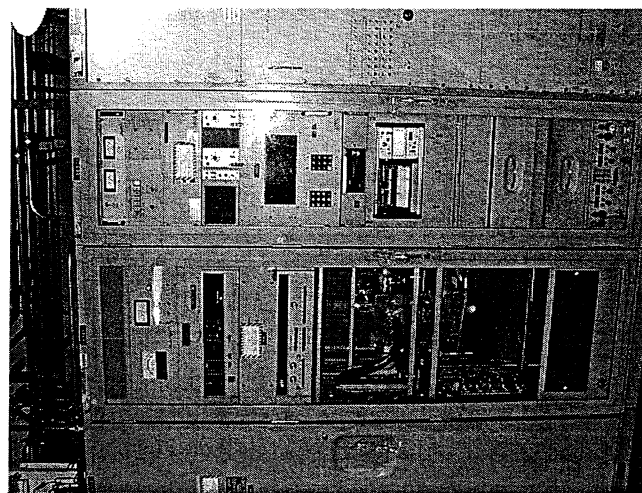
Cryogenic Fuel System

- 1,773,000 Liters of LH_2
- 660,000 Liters of LO_2



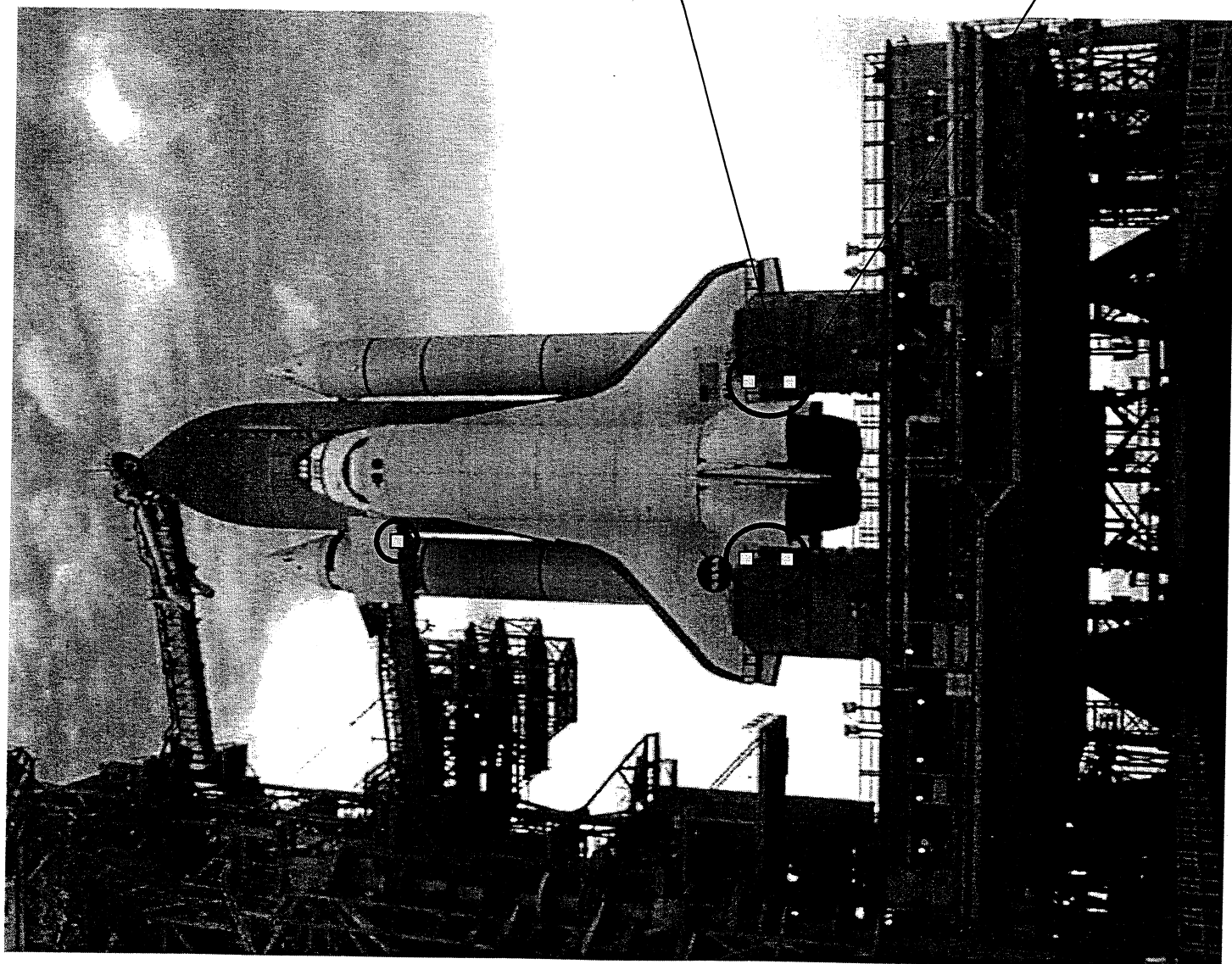
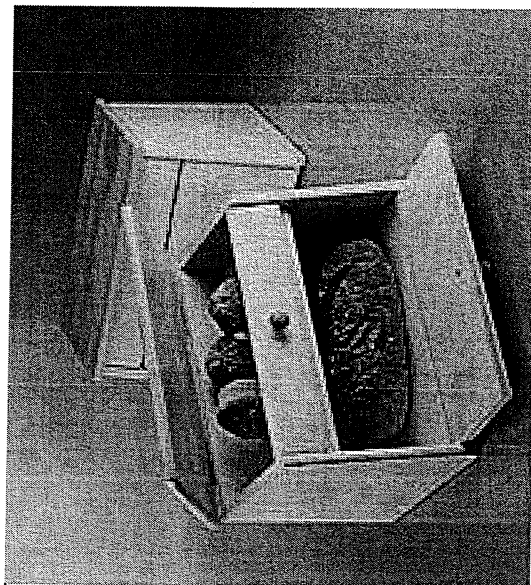
Current

Leak Detection



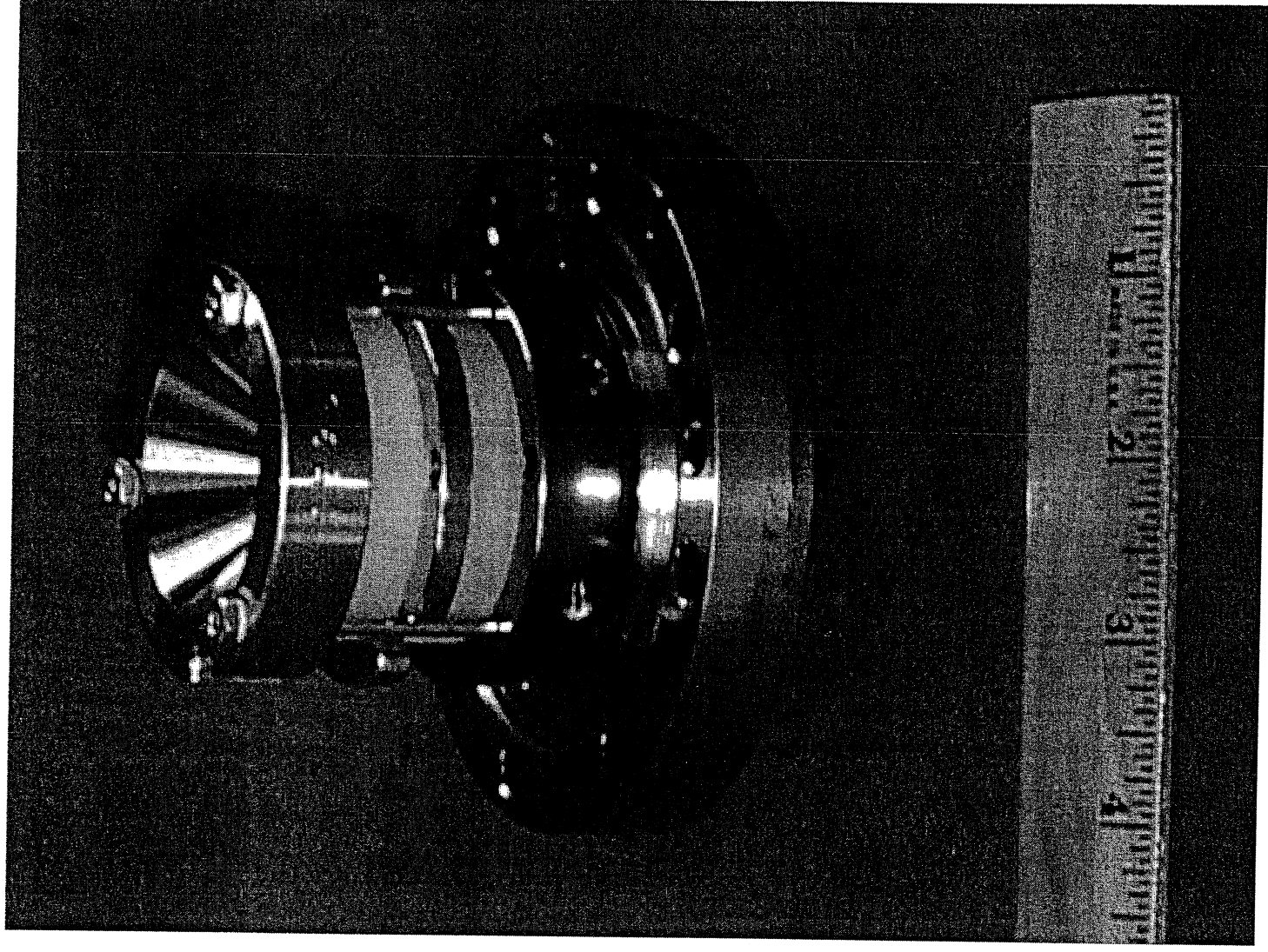
Future

Leak Detection



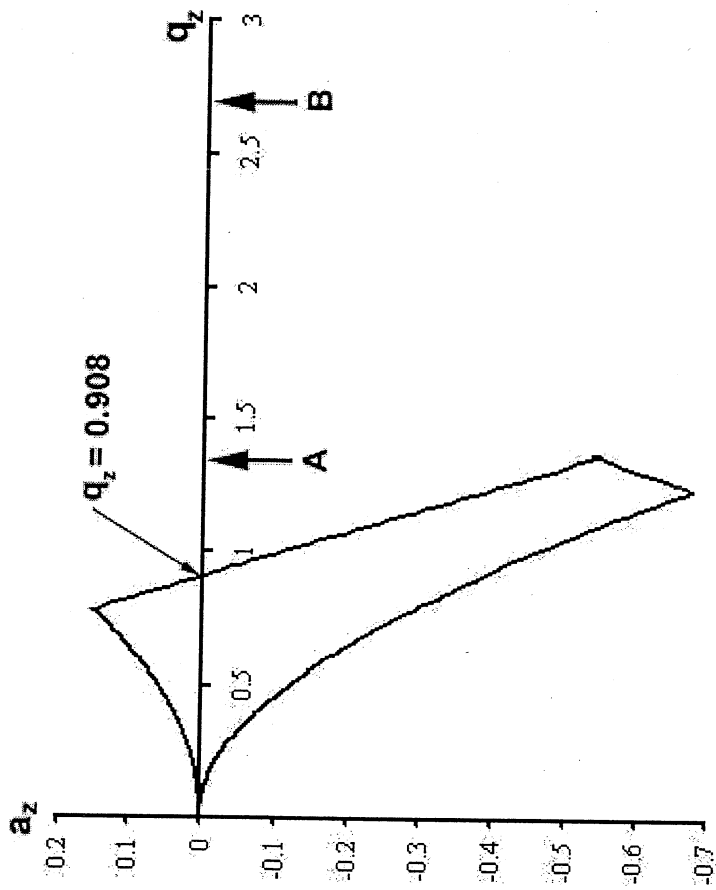
QITMS

- 2 – 50 Da
- Fast Analysis
- Miniature &
Rugged

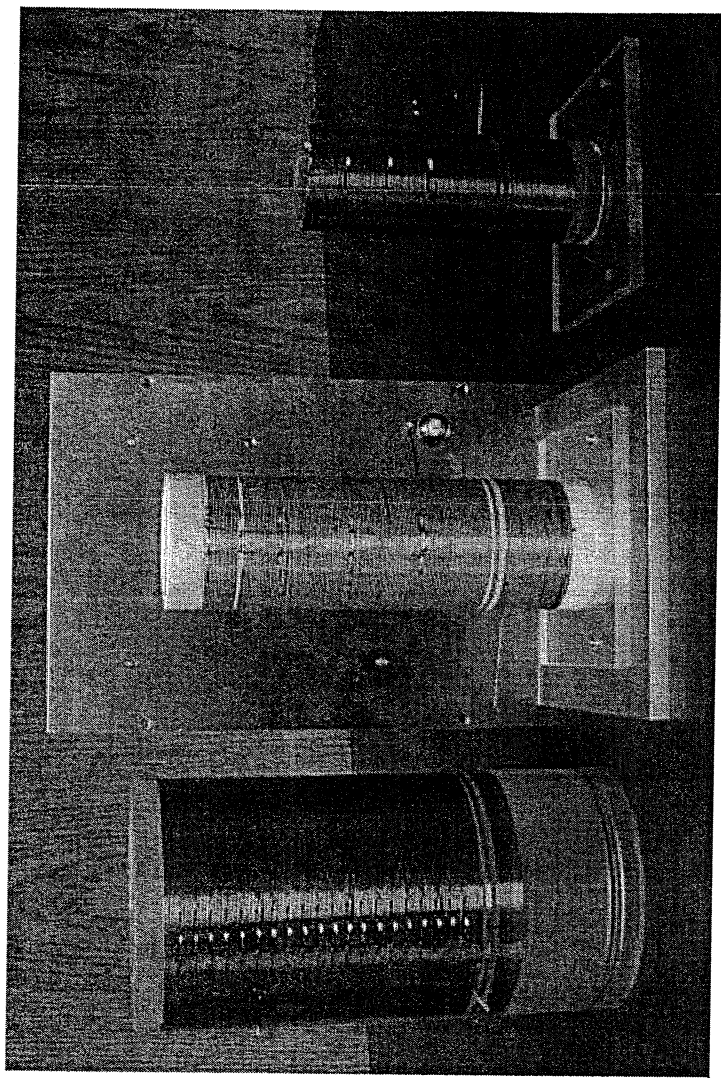
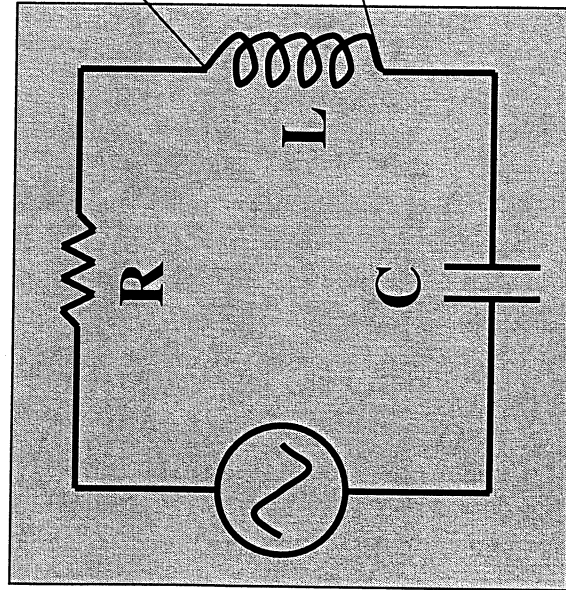
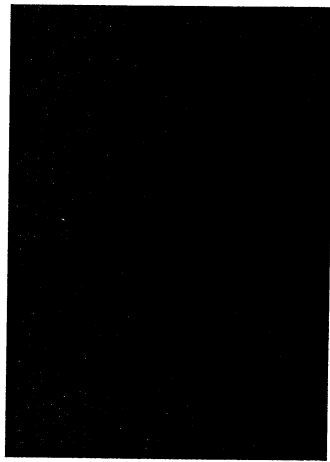


Modify Mass Range

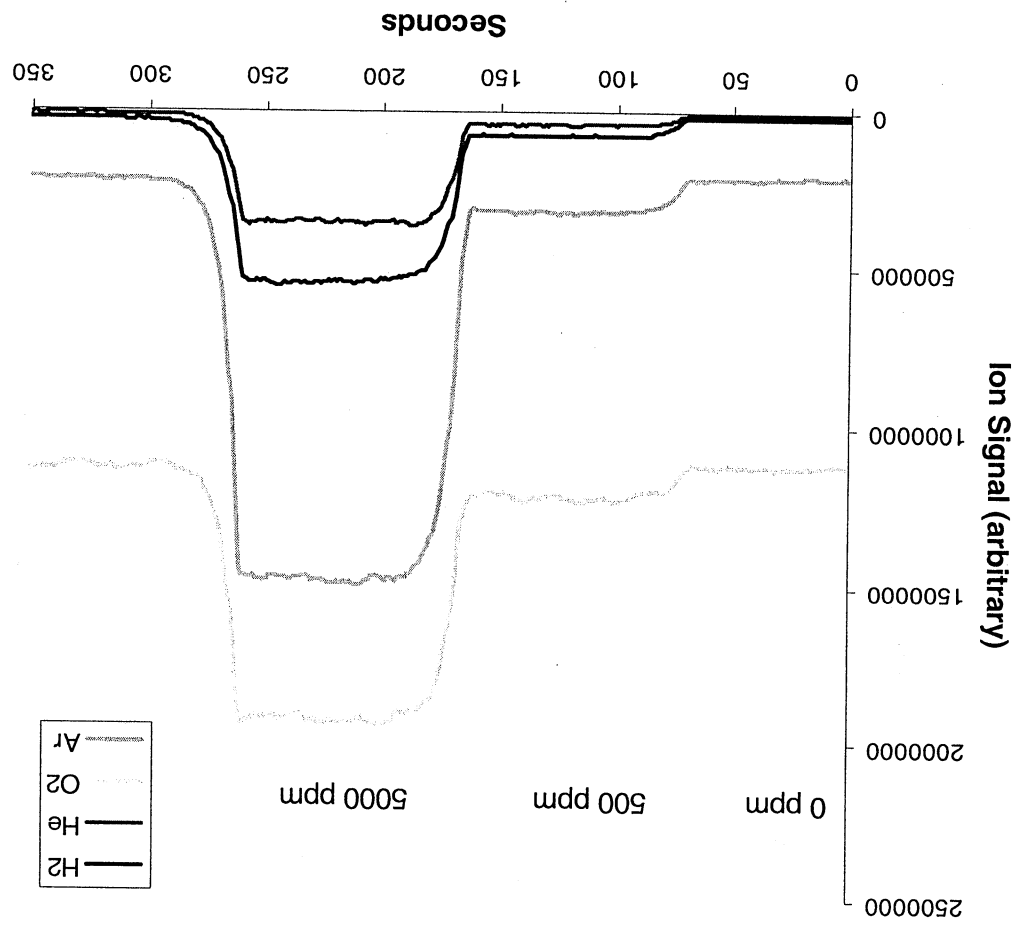
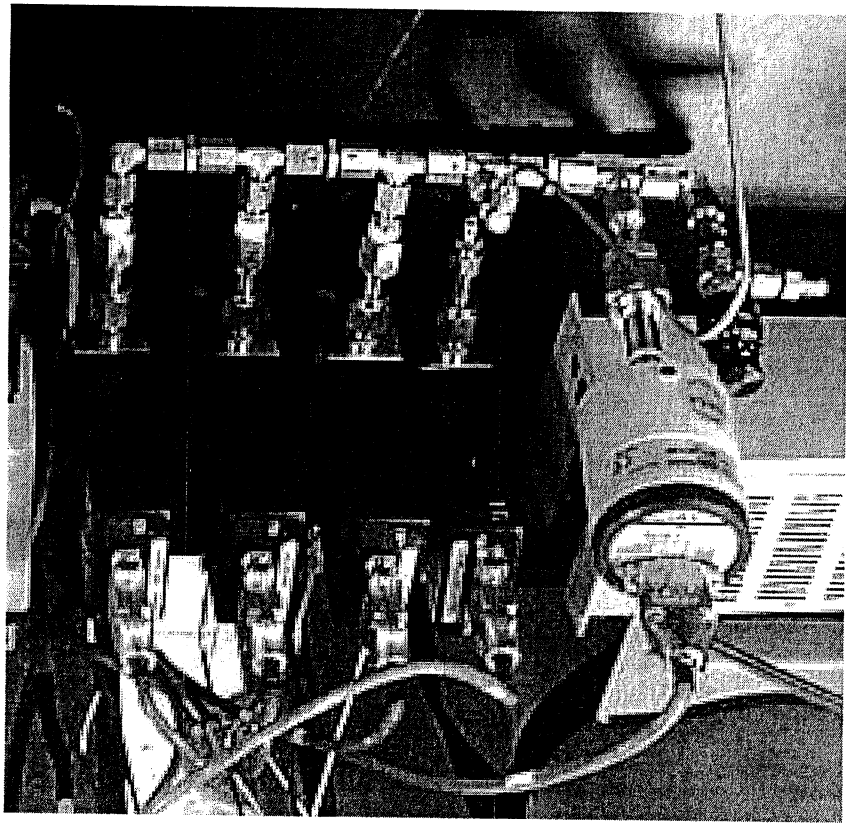
$$m/z q_z = \frac{8eV_{RF}}{(r_0^2 + 2z_0^2)\Omega^2}$$



RF Circuit

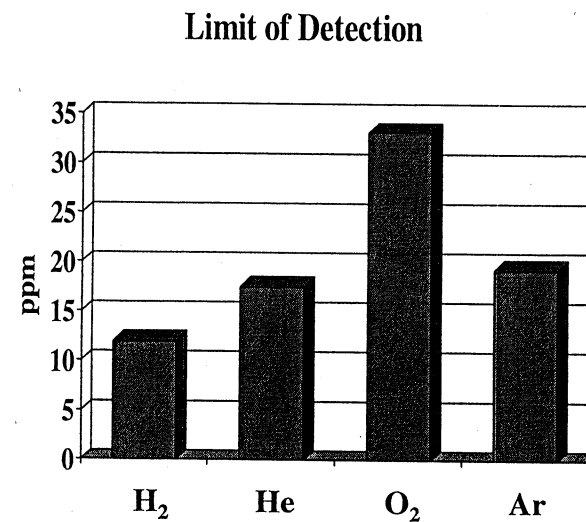
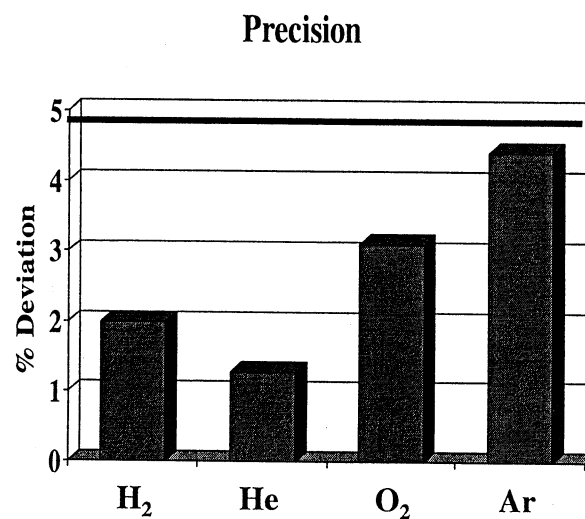
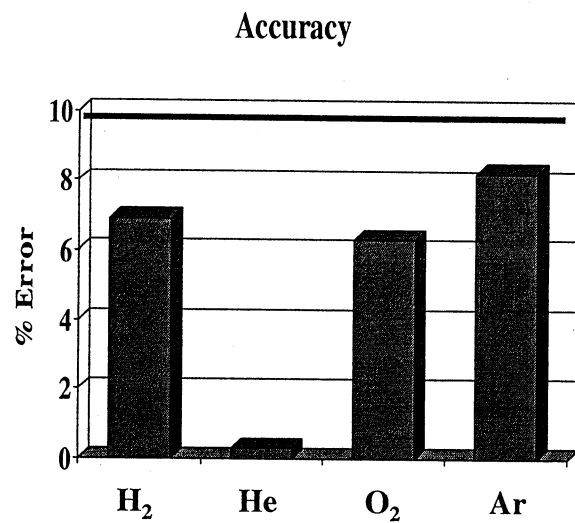


2.5 MHz \longrightarrow 2 to 60 Da



Testing

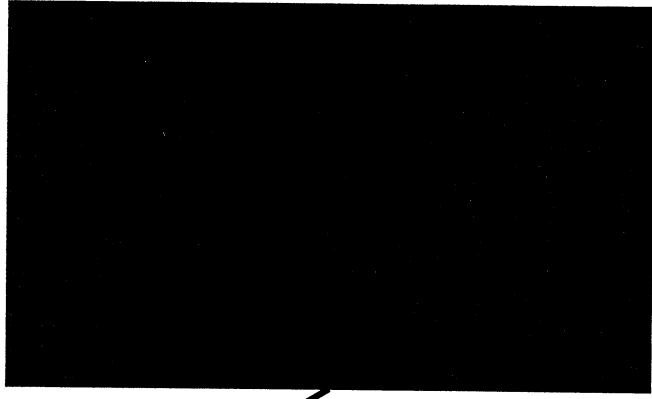
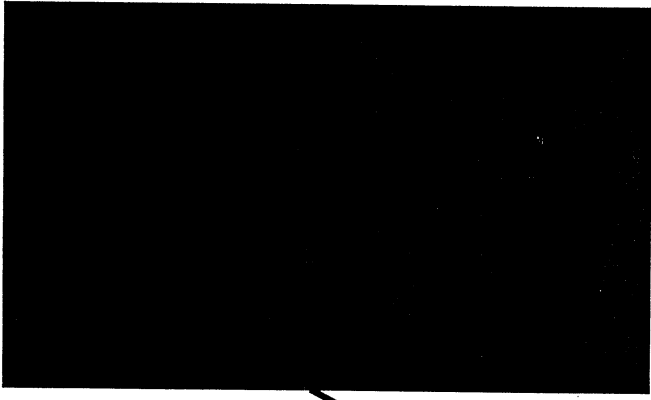
Quantitative Results



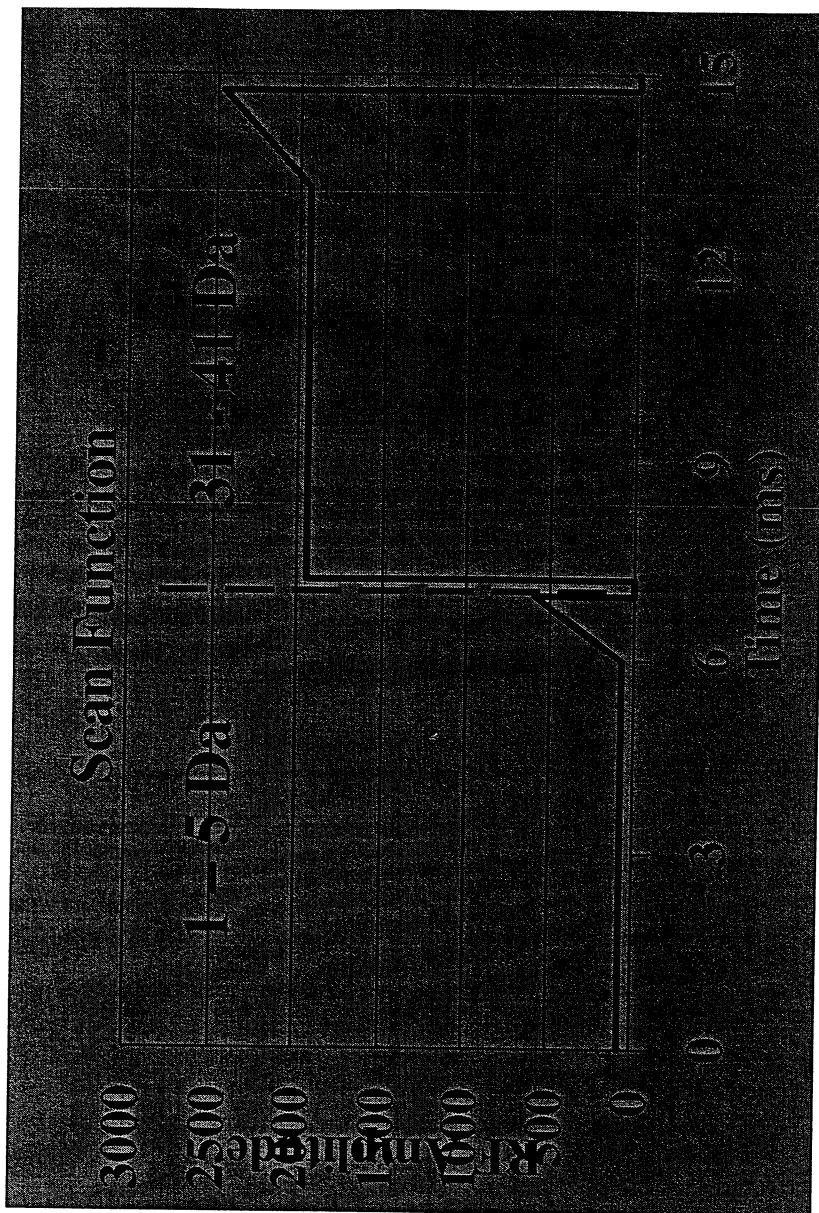
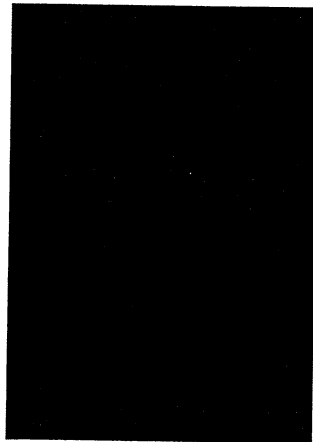
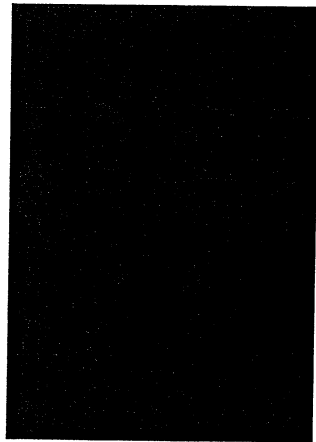
Trapped Ions

More Ions = More Signal

Or Not?

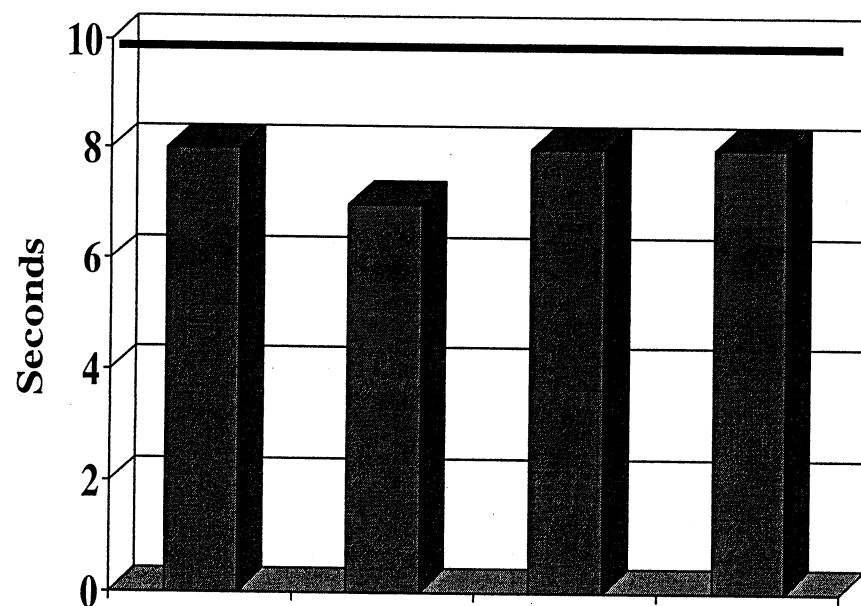


Go Fast...

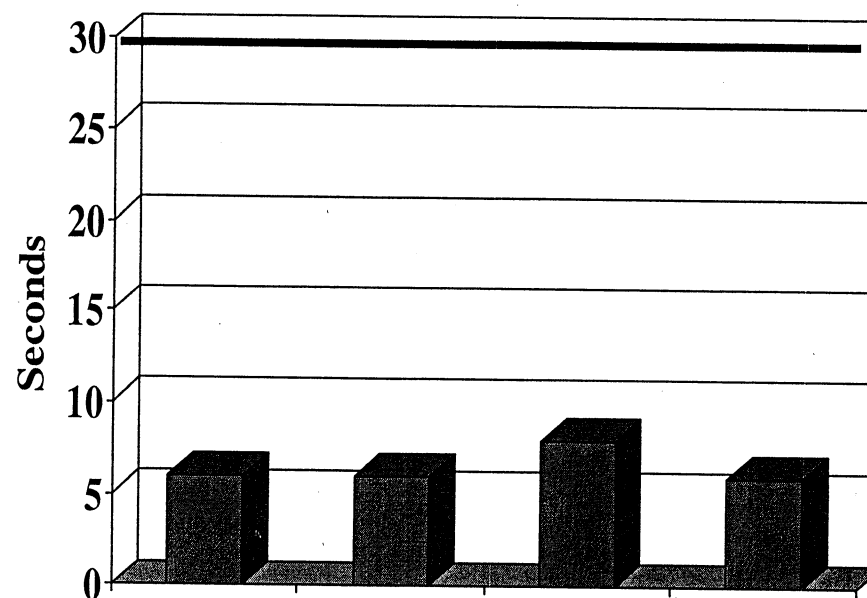


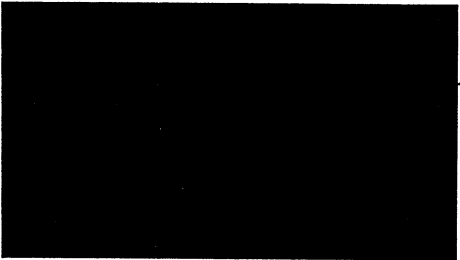
Quick Response

Response Time



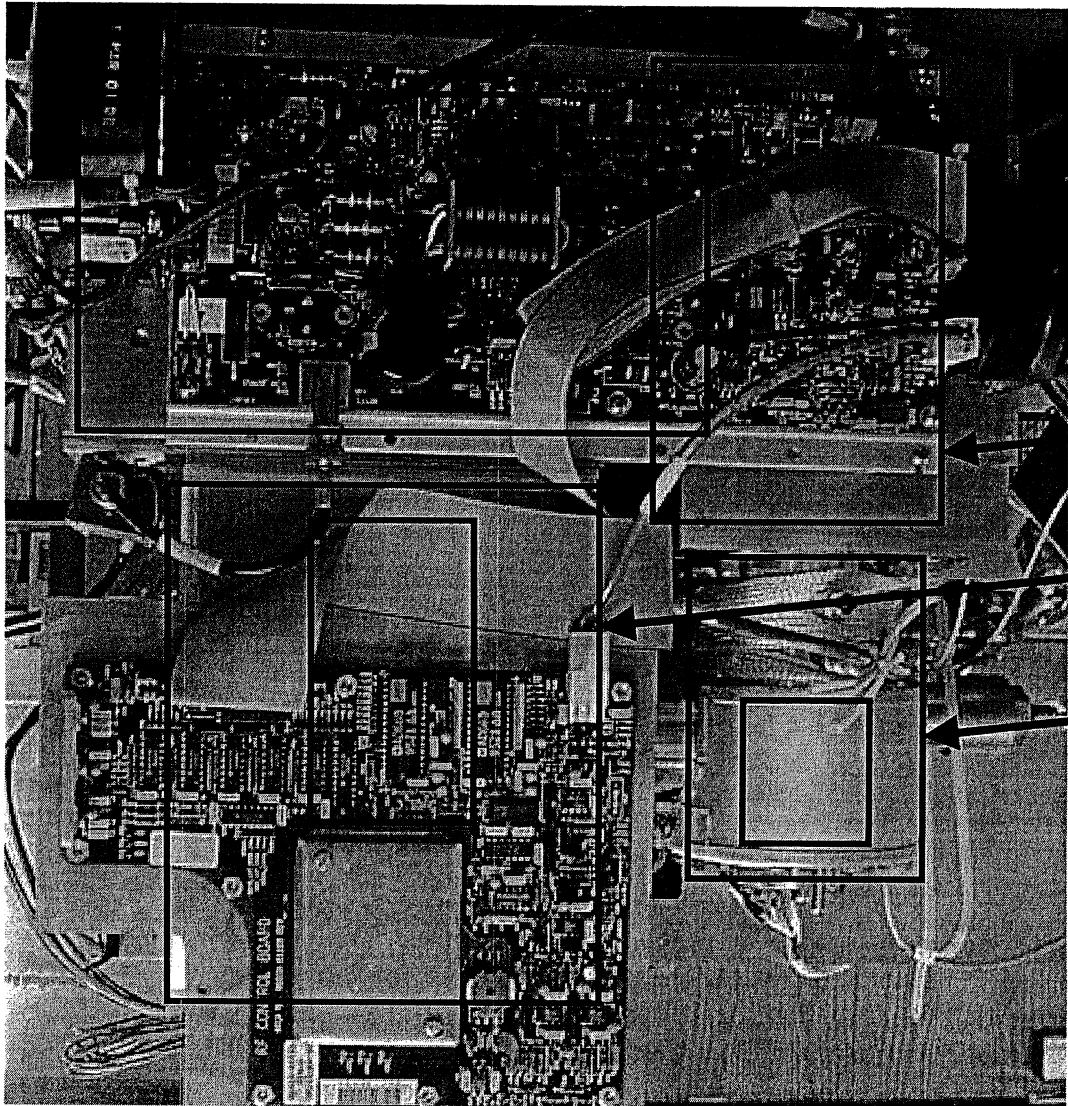
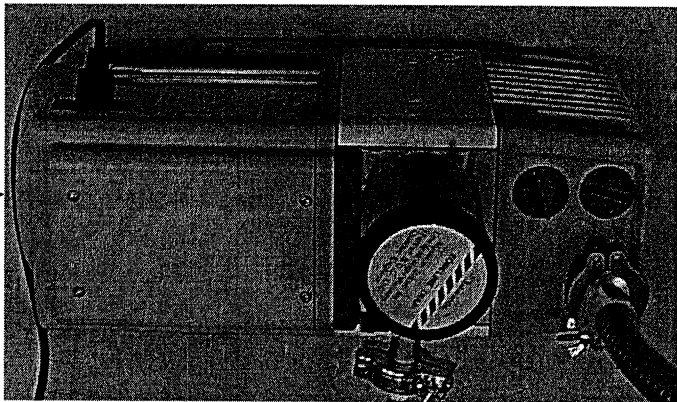
Recovery Time





• 20%

• 20%



• 8%

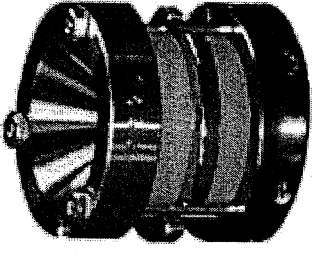
• 5%

• 6.5%

• 2%

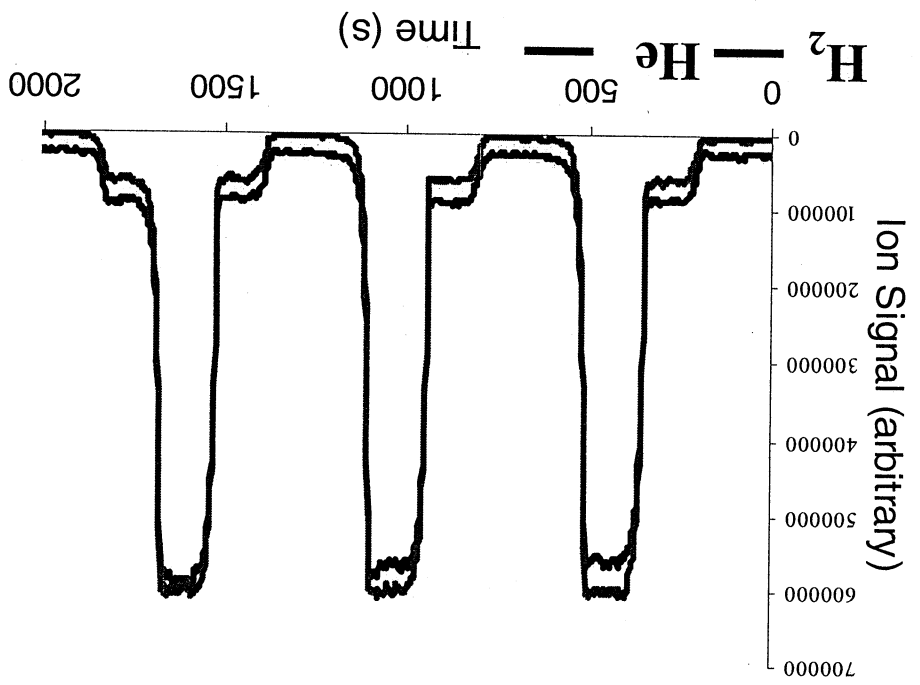
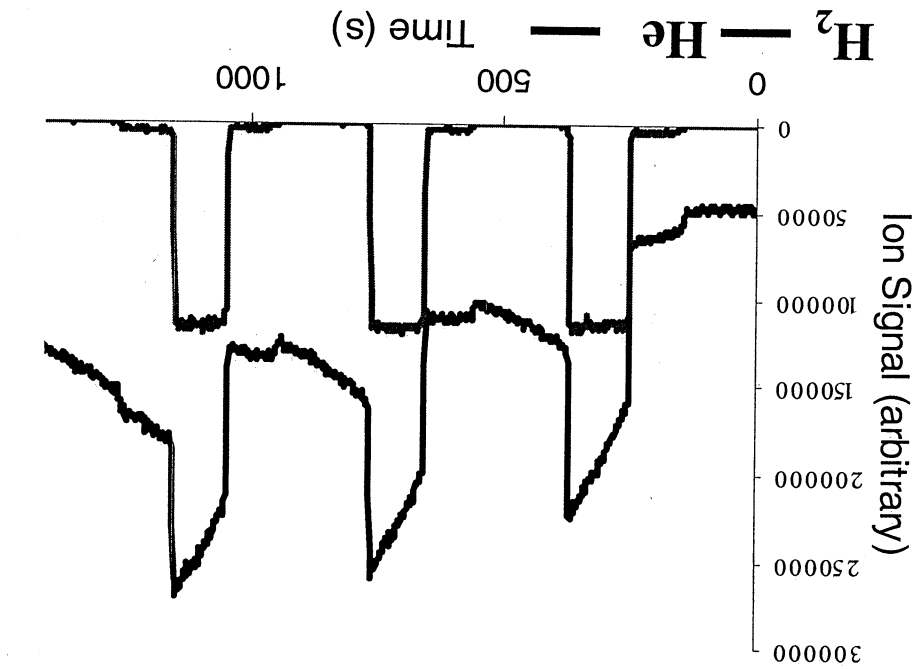
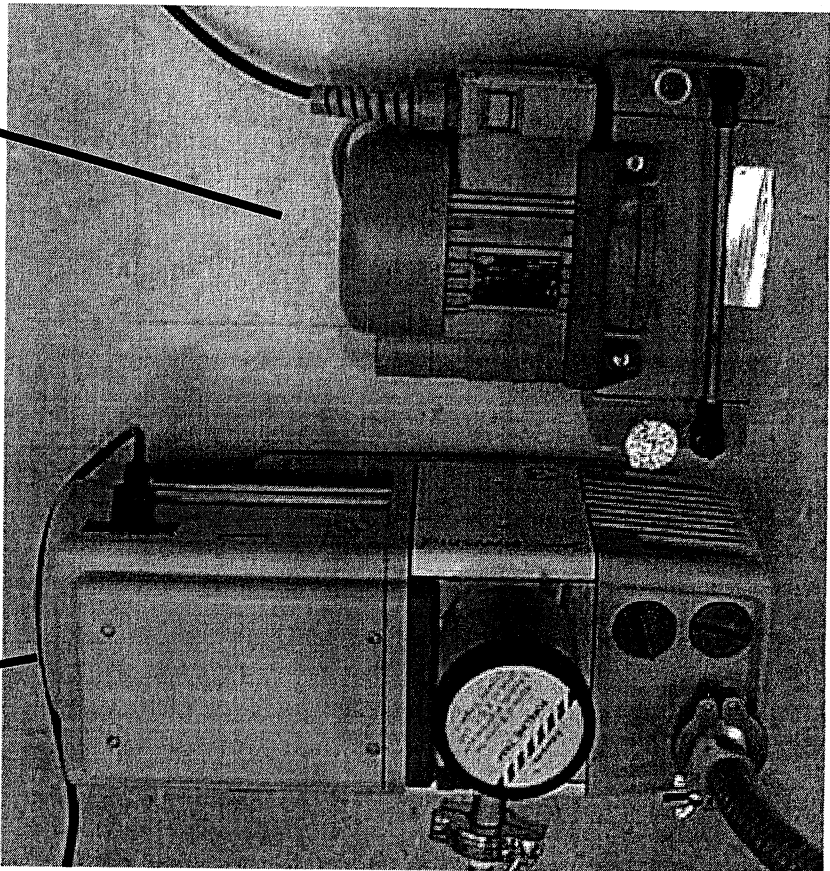
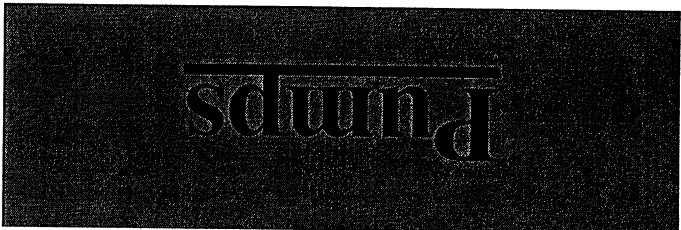
Miniature ?

1/2 Size Trap



Reduce r_0 & z_0 by $1/2$:

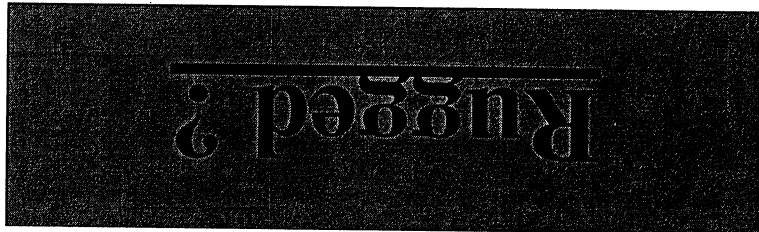
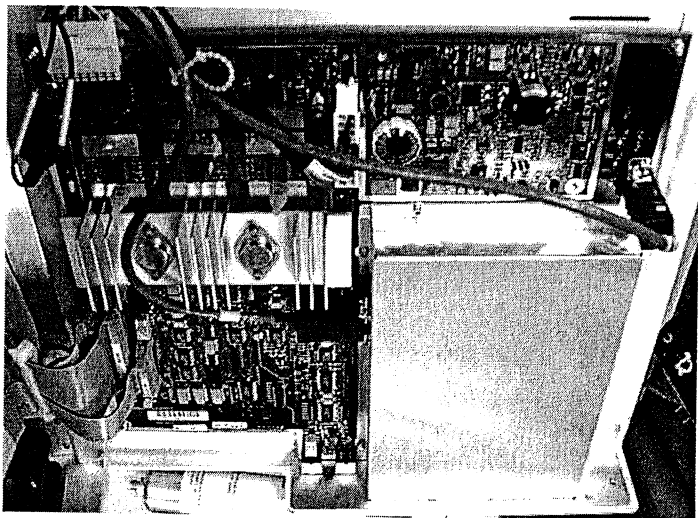
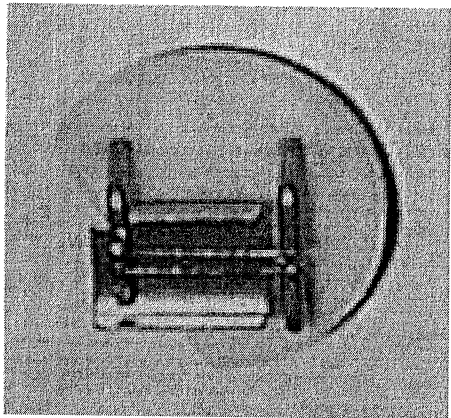
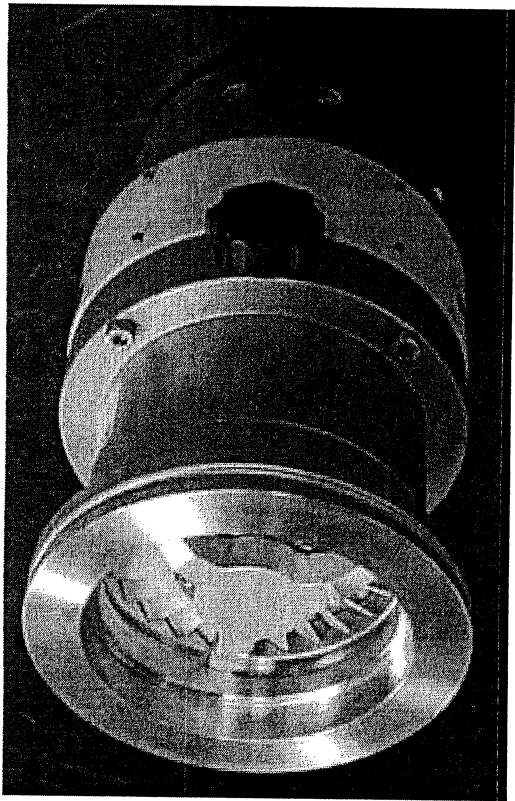
- **1/8th Trap & Manifold**
- **1/2th RF Coil & Coil Box**
- **Less Power**
- **Less Pumping**



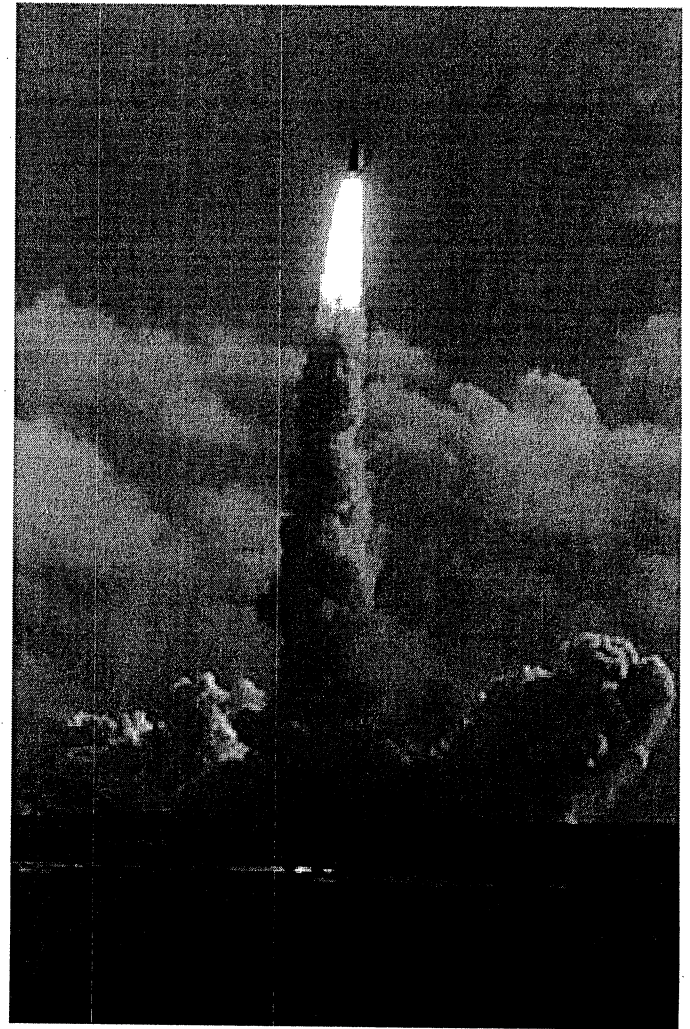
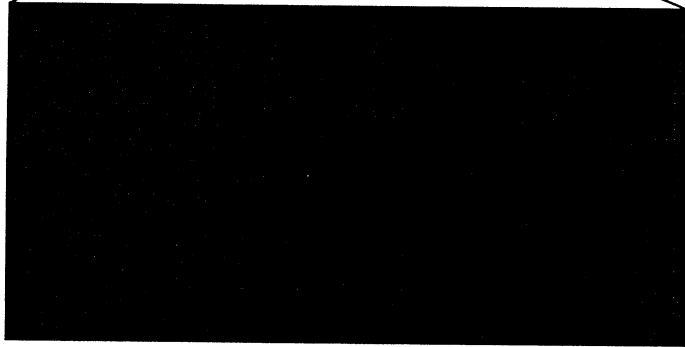
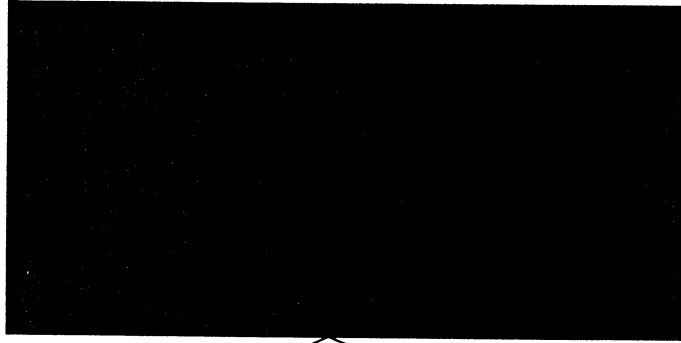
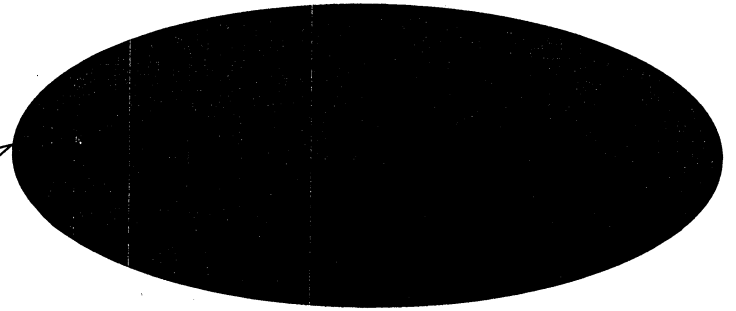
• Vacuum Pumps

• Source Filament

• Solid State



Conclusions



Acknowledgements